technology ■ opportunity

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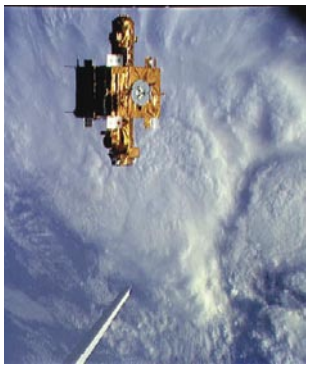
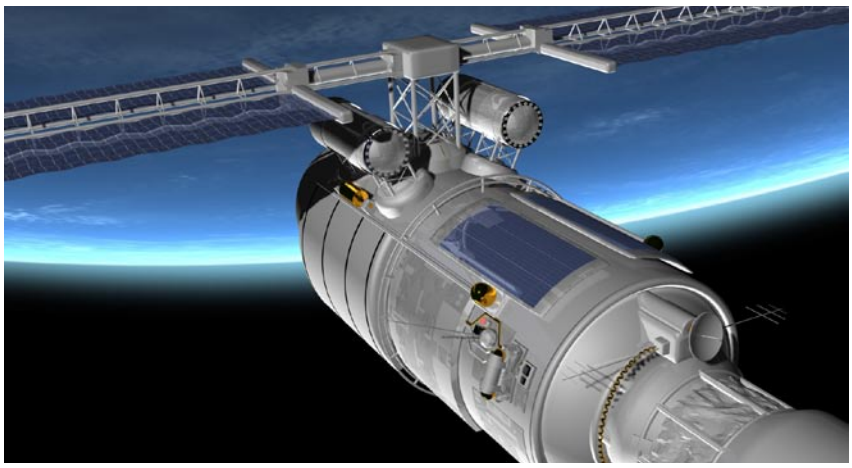
A Demiseable Reaction Wheel Assembly

...lowering the cost, complexity, and risk of uncontrolled re-entry for LEO missions





NASA Goddard Space Flight Center invites companies to license its new, patent-pending reaction wheel assembly (RWA) that is designed to melt or burn up (demise) upon re-entry to Earth's atmosphere, making it ideal for low Earth orbit (LEO) missions. The simple, modular design also makes it a good option for small and large spacecraft in other orbits.

Goddard's RWA assembly helps make uncontrolled re-entry to Earth's atmosphere possible. Because controlled re-entry (in which the spacecraft is disposed of into the ocean) can be more costly, complex, and risky, uncontrolled re-entry is an attractive option. It also greatly reduces debris (the remains of the spacecraft itself) left in orbit or deposited into the ocean. The demiseable RWA is the first and only reaction wheel of its size to facilitate the option of uncontrolled re-entry.

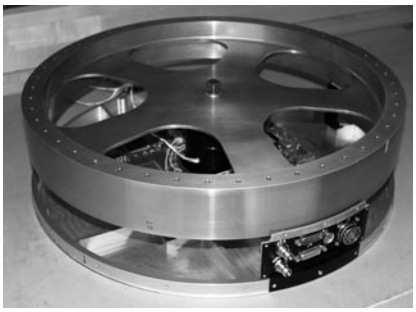
Benefits

- **Simplified space missions**: Removes the need for special propulsion systems, extra fuel, and additional mission planning required of controlled re-entry
- **Modular design**: Offers reduced complexity, providing for reduced manufacturing costs and simpler assembly and balancing as compared with traditional designs
- **Scalable**: Momentum storage from 10 to 80 Nms and torque up to 0.5 Nm allow the RWA to be tailored to specific applications on all sizes of spacecraft
- **Innovative**: Combines materials that melt at relatively low temperatures with an architecture that makes exposure to heat very efficient, enabling complete demise
- **Low risk**: Helps to lower the risk of re-entry for LEO missions by making uncontrolled, demiseable re-entry possible

Applications

The demiseable RWA facilitates attitude control for small- to large-size spacecraft for:

- LEO missions
- GEO missions
- Lunar and Martian missions



Technology Details

How it works

Goddard's demiseable RWA combines material choices, part design, and layout that make the design completely demiseable, aiding uncontrolled re-entries. The technology features new designs for the flywheel and motor stator. Constructed of aluminum, the flywheel has a low melting temperature, aiding in faster demise of the entire assembly. In addition, the stator contains very little iron, which melts at a higher temperature.

In addition to employing highly demiseable materials, the design of the RWA itself also facilitates maximum demise efficiency and predictability. Rounded cutouts in the web, or inner portion, of the flywheel limit the amount of heat blocked from initial exposure to Earth's atmosphere. This allows the web of the flywheel to burn away more quickly. The rim of the flywheel will then separate, exposing to heat the majority of the material contained in the flywheel itself. Because of the aluminum construction and the unique cutouts, the flywheel melts away quickly, efficiently exposing other materials to the heat of re-entry. The stator and magnet assemblies in Goddard's design are located within a center housing, providing an easily demiseable structure that is exposed to the heat coming in through the flywheel cutouts.

Why it is better

Design choices typical of other RWAs, such as the use of stainless steel or titanium flywheels, make them unable to demise completely or predictably, eliminating the option of uncontrolled re-entry. In contrast, Goddard's RWA uses materials, part design, and layout that expedite and ensure complete demise. Uncontrolled re-entry is an important goal for many LEO missions and may play a larger role in mission planning in the future.

Goddard's RWA is designed from a systems perspective to limit the size, complexity, and cost involved in LEO missions. Its low-power design puts less strain on the spacecraft power systems. Solar panels and batteries can be smaller and lighter, thus reducing overall spacecraft size and mass. In addition, the cantilevered flywheel design allows the reaction wheel to be balanced entirely in its fully assembled configuration, resulting in fine balancing at a relatively low cost.

Patents

NASA Goddard is seeking patent protection for this technology.

Licensing and Partnering Opportunities

This technology is part of NASA's Innovative Partnerships Program, which seeks to transfer technology into and out of NASA to benefit the space program and U.S. industry. NASA invites companies to consider licensing the Demiseable Reaction Wheel Assembly technology (GSC-14845-1) for commercial applications.

For More Information

If you are interested in more information or want to pursue transfer of this technology (GSC-14845-1), please contact:

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More information about working with NASA Goddard's Office of Technology Transfer is available online:
http://techtransfer.gsfc.nasa.gov

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